Florida Power & Light Company, 6501 S. Ocean Drive, Jensen Beach, FL 34957

FPL

February 2, 2004

L-2004-018
10 CFR § 50.73

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Re: St. Lucie Unit 2
Docket No. 50-389
Reportable Event: 2003-004-00
Date of Event: December 4, 2003
Condensate Pump Motor Bearing
Failure Resulted in Manual Reactor Trip

The attached Licensee Event Report 2003-004 is being submitted pursuant to the requirements of 10 CFR § 50.73 to provide notification of the subject event.

Very truly yours,

William Jefferson, Jr.
Vice President
St. Lucie Nuclear Plant

WJ/KWF
Attachment

JE22

NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COM

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)

Condensate Pump Motor Bearing Failure Resulted in Manual Reactor Trip

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	04	2003	2003	- 004 -	00	02	02	2004	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1
POWER LEVEL (10)	60

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
	[redacted]		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
	20.2203(a)(1)		50.36(c)(1)(i)(A)	X	50.73(a)(2)(iv)(A)		73.71(a)(4)
	20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)		OTHER
	20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)		
	20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)		
	20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
	20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Kenneth W. Frehafer, Licensing Engineer	(772) 467 - 7748

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
E	SD	MO	A180	YES	-	-	-	-	-

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On December 4, 2003, St. Lucie Unit 2 was in Mode 1 at 100 percent power. At approximately 1600 hours, the control room operators were informed that the lower motor bearing area of condensate pump 2A was "hot and smoky." At 1605 hours, a rapid downpower was initiated to reach 45 percent power in order to remove condensate pump 2A from service. At 1632 hours, the operators manually tripped the reactor from 60 percent power due to the rapidly degrading condition of the 2A condensate pump. The plant was stabilized in Mode 3. All safe shutdown equipment operated as designed. There were no human performance issues related to the downpower or manual trip.

The most probable cause of the lower motor bearing failure was determined to be improper lubrication. Plant procedures incorrectly identified that the bearing was factory sealed and required no lubrication.

Corrective actions include the planned inspection and repair of the 2A condensate pump and motor, correction of the procedural error, identification of other motors with incorrect bearing classifications, and increased predictive maintenance vibration and thermography analyses for those motors until the bearings are lubricated and/or replaced.

Description of the Event

At about 1553 hours On December 4, 2003, St. Lucie Unit 2 was in Mode 1 at 100 percent power when the annunciator for the 2A condensate pump bearing low cooling water flow alarmed. Operators were dispatched to the area, and at approximately 1600 hours the control room operators were informed that the lower motor bearing area of condensate pump 2A was "hot and smoky." A fire team was immediately dispatched to the area and a rapid downpower was initiated. Power level had to be reduced below 45 percent in order to remove condensate pump 2A from service.

The condition of condensate pump 2A rapidly degraded during the downpower. The marked increase in pump vibration broke the cooling water line to the 2A condensate pump upper motor bearing. The operators manually tripped the condensate pump, the reactor, and the turbine at 1632 hours at approximately 60 percent power.

The plant was stabilized in Mode 3. All safe shutdown equipment operated as designed. There were no human performance issues related to the downpower or manual trip.

Major anomalies identified during the trip included the failure of PCV-8801, an automatic steam dump to condenser valve in the steam bypass control system (SBCS), to automatically or manually open. Additionally, several radiation monitors caused spurious alarms and actuations. Actuations included isolation of steam generator blowdown, the control room ventilation system aligned to the recirculation mode, and the fuel handling building ventilation aligned to the shield building ventilation system.

The condensate pump motors are 4kV, 4000 HP, vertical motors. The upper bearing assembly includes a tilting pad thrust bearing and a sleeve type radial bearing. The upper bearing assembly is oil lubricated and cooled by turbine plant cooling water. The upper bearing assembly is electrically insulated from the motor frame to prevent damage to the upper and lower bearings from circulating currents. The lower bearing is a grease lubricated deep groove ball bearing.

There are three condensate pumps in the system. Although the pumps mechanically operate in parallel, only two pumps are electrically capable of running at a time. The 2A and 2B condensate pumps were in operation and are powered from 4kV buses 2A2,and 2B2, respectively. Condensate pump 2C may be powered from either bus 2A2 or 2B2, depending on the alignment of the condensate pump transfer switches. The condensate pump that is not operating is electrically disconnected.

When needed as a replacement for either the A or B pump, the C pump is electrically aligned to the breaker of the pump it is replacing and then controlled from the replaced pump's START/STOP control switch in the control room. The transfer switch positions are key locked to prevent both transfer switches from being operated and the respective 4160 breaker must be racked-out prior to performing the transfer operation to assure equipment and personnel protection. The transfer switch is capable of carrying normal current, but is not designed or rated to interrupt a running pump. This requires the pumps being swapped to be deenergized prior to any alignment changes.

Cause of the Event

The operators manually tripped St. Lucie Unit 2 to preclude catastrophic failure of the 2A condensate pump. The most probable cause of the 2A condensate pump lower guide motor bearing failure was improper lubrication of the bearing. The reason for

the inadequate lubrication is that the plant lubrication manual, GMP-22, included inaccurate information indicating that the motor lower guide bearing required no lubrication. This latent error was introduced in 1994 when the instructions from several lubrication procedures were combined into a single document, MP-0010446. This procedure was the predecessor to GMP-22. Revision 0 of MP-0010446 listed the St. Lucie Unit 2 condensate and circulating water pump motors as having sealed bearings. The procedure which preceded MP-0010446 was MP-0010441, Rev 2. MP-0010441 listed the condensate pump motors as having "pressure gun grease fittings." The cause of the procedure discrepancy was lack of attention to detail during the preparation of the procedure.

The plant lubrication manual, GMP-22, indicated that the lower guide bearing is a sealed, grease lubricated ball bearing. This type of bearing is factory lubricated for life and can not be lubricated in service. As such, there was no preventive maintenance (PM) activity to change the grease in this bearing, and the motor bearings were replaced each time the motor was overhauled. The EPRI electric motor predictive and preventative maintenance guide, EPRI NP7502s, recommends re-greasing a motor open bearing every 24 to 36 months, but lower guide bearing re-greasing intervals of up to 72 months are seen in the industry for motors of this type. Additionally, in June 2001, this motor was placed in a condition based maintenance program. Under this program, the bearing condition is monitored by vibration analysis and thermography to determine when overhaul is recommended. The monitoring data showed no trend of degradation prior to the failure.

Before the condensate pump motors were placed in a condition based maintenance program, they were scheduled for overhaul on a 72-month frequency. The bearings are replaced during overhauls. The 2A condensate pump motor was last overhauled in March of 1994 and a new bearing was installed at that time. The service period of almost 10 years is well beyond generic industry guidance for changing the lubricant in grease lubricated bearings. The 2C condensate pump motor has operated approximately 85 months, and the 2B condensate pump motor has operated approximately 26 months since their last overhauls.

PCV-8801, one of the five SBCS air-operated globe valves, failed due to a degraded rubber seal that separates the manual actuator housing from the upper chamber of the main valve actuator. The degraded sealing capability allowed the loss of upper chamber air pressure. Since PCV-8801 is reverse acting, the loss of upper chamber air pressure prevented the valve from going open on demand. The degraded seal was replaced. Generically, the SBCS air-operated globe valves were not in the PM program. However, prior to this event St. Lucie recently approved PMs to inspect the SBCS valve operators on a 54-month frequency.

Trip-related power perturbations resulted in the affected radiation monitor channels entering their fail-safe mode on a detected loss of power. Unit 2 radiation monitors are sensitive to power source transients. The channels were reset and subsequently returned to service.

Analysis of the Event

This event is reportable under 10 CFR 50.73(a)(2)(iv)(A) as any event or condition that resulted in the manual actuation of the reactor protection system (RPS).

Analysis of Safety Significance

Reactor trips are analyzed events. All safe shutdown equipment operated as designed. The failure of PCV-8801 required operation of the SBCS in manual mode with valve PCV-8802. Manual operation of the SBCS required periodic manual operation of the feedwater control system due to mismatches in steam demand and feedwater. However, these actions posed no challenge to maintaining the reactor in a safe shutdown condition. Additionally, the spurious radiation alarms and actuations resulted in the affected equipment operating in their fail-safe mode. Therefore, this event had no adverse impact on the health and safety of the public.

In order to address the generic consideration of the miss-identified bearing type, Electrical Maintenance performed an initial review of all the St. Lucie Unit 1 and 2 motors that were listed as having sealed bearings in GMP-22. This initial review revealed that only the St. Lucie Unit 2 condensate and circulating pump motor lower guide bearings were incorrectly identified in GMP-22. No additional discrepancies were found. A more detailed verification to assure that all motors identified in GMP-22 as having sealed bearings are correctly identified is scheduled as a corrective action. Based on the maintenance history of the Unit 2 condensate pumps, St. Lucie increased the predictive maintenance vibration and thermography testing frequency of the condensate pumps, as well as recording shiftly temperature readings, until bearing lubrications are complete. No bearing failure event precursors have been identified at this time.

Corrective Actions

1. The plant was stabilized in Mode 3.
2. Condensate pump 2C was lined up to replace condensate pump 2A.
3. The 2A condensate pump motor was shipped offsite for vendor overhaul and will be reinstalled after the overhaul is completed (work order (WO) 33021561).
4. The 2A condensate pump will be overhauled and inspected for possible causes of the motor bearing failure (WO 33021584).
5. The degraded seal on PCV-8801 was replaced (WO 33011580).
6. Procedure GMP-22 was revised to correct the motor bearing type for the St. Lucie Unit 2 condensate and circulating pumps.
7. FPL will complete a detailed verification of the sealed bearing listing in GMP-22.
8. PMs were developed to periodically grease the St. Lucie Unit 2 condensate and circulating pump motor lower guide bearings.
9. FPL is evaluating corrective actions to preclude radiation monitor spikes due to electrical power fluctuations.
10. FPL increased the predictive maintenance vibration and thermography testing frequency for the condensate pumps, as well as the shiftly recording of temperature readings, until bearing lubrications are complete.
11. FPL is scheduling a St. Lucie Unit 2 downpower in order to grease the 2C condensate pump motor lower bearings (the condensate pump with the most run time) by February 15, 2004.

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		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

Additional Information

Failed Components Identified

Component Tag: Cond Pp 2A Motor

Manufacturer: Allis Chalmers Mfg. Co.

Model Number: ANVOD

Serial Number: 47302-1

Similar Events

None